



LTPP North Central Regional Office

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June 15, 2001

Mr. Jack Springer, HRDI-13
FHWA-LTPP
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, Virginia 22101-2296

Re: SPS Construction Report for SPS-9A near Grand Rapids, Michigan

Dear Mr. Springer,

I have enclosed a copy of the construction report for the SPS-9A project near Grand Rapids, Michigan. The report for the remaining project in Michigan (SPS-1) will be completed in the near future, and sent to you as it becomes available. Please let me know if you have any comments or questions concerning this report. You may contact me at 217/356-4500.

Sincerely,

Brenda B. Mehnert
ERES Division of ARA, Inc.

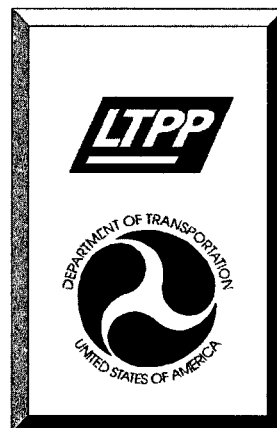
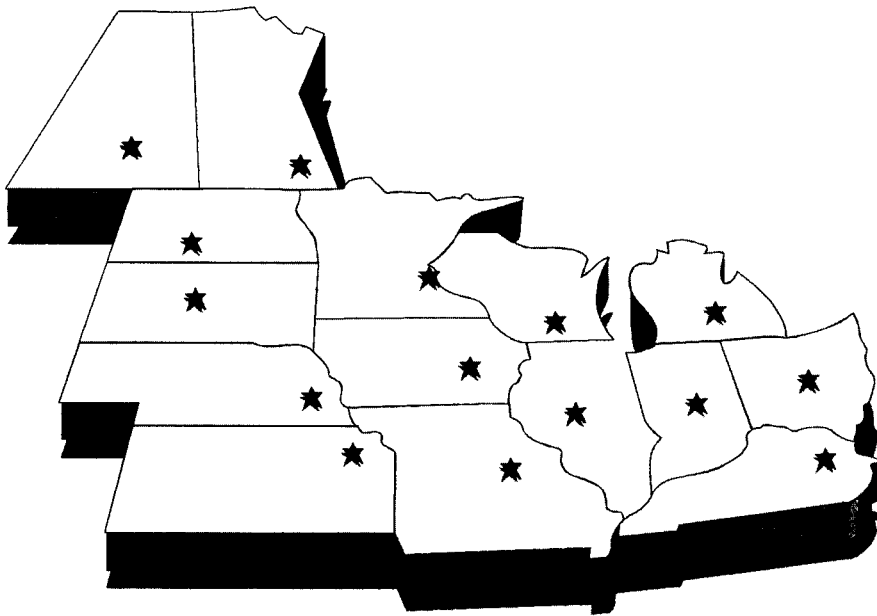
Enclosures:

cc: M. Symons (FHWA-COTR)
J. Jiang (LTPP-DATS)

Construction Report for Michigan SPS-9A

DTFH61-96-C-00013

June 15, 2001



**SPS-9A Construction Report
I-196, Eastbound
Ottawa County, Michigan
West of Grand Rapids, Michigan

Sections 260901, 260902, 260903**

**Federal Highway Administration
LTPP Division
North Central Region**

Report Prepared By
Brenda B. Mehnert

ERES Consultants
A Division of Applied Research Associates, Inc.
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June 15, 2001

Table of Contents

1 PROJECT OVERVIEW	1
1 1 EXPERIMENT CELL	1
1 2 PROJECT LOCATION	1
1 3 PROJECT LAYOUT	2
1 4 ROADWAY AND TRAFFIC CHARACTERISTICS	2
1 5 LIMITS OF TEST SECTIONS	2
1 6 WEATHER MONITORING	2
1 7 TRAFFIC MONITORING	3
1 8 PERSONNEL	3
1 9 KNOWN DEVIATIONS FROM GUIDELINES	5
1 10 SUMMARY OF KEY CONSTRUCTION EQUIPMENT	5
2 PROJECT DETAILS	6
2 1 DESIGN FEATURES	6
2 2 MATERIAL SAMPLING AND TESTING	6
2 3 CONSTRUCTION ACTIVITIES	6
2 5 INITIAL PERFORMANCE	8

ATTACHMENTS

ATTACHMENT A: PROJECT LOCATION

ATTACHMENT B: SITE LAYOUT

ATTACHMENT C: MATERIAL SAMPLING AND TESTING PLAN

ATTACHMENT D: LAYER DESCRIPTION AND THICKNESS FOR EACH SECTION

ATTACHMENT E: PROJECT DEVIATION REPORTS

1 Project Overview

The Strategic Highway Research Program (SHRP) SPS-9A project investigates the further development and refinement of performance-based specifications for asphalt binder and asphalt-aggregate mixtures. In order to be successful, it is necessary to validate the binder and mixture properties as important determinants of in-place pavement performance. The evaluation of innovative asphalt pavement materials also requires in-service testing under actual traffic and climate conditions.

The study objectives are as follows:

- To compare the SHRP binder selected based on the average maximum and minimum temperatures and the annual precipitation.
- To compare to local agency mix designs
- To compare the alternate binder selected to evaluate cases of thermal cracking or rutting
- To study additional (supplemental) test sections, such as stone matrix asphalt (SMA)

The comparisons should involve three test sections in the core experiment with the same pavement cross-section.

This report summarizes the “as-built” pavement layers of the Michigan SPS-9A site consisting of three SHRP test sections and no supplemental sections. Field tests were performed, and laboratory samples obtained and analyzed, at different stages of construction from each test section. All samples were taken from the outer lane.

1.1 Experiment Cell

The Michigan SPS-9A experiment is located in the wet-freeze environmental zone. Annual precipitation at the site is greater than 635 mm. The average monthly temperature in Grand Rapids ranges from -11°C to $+24^{\circ}\text{C}$. The average 7-day maximum pavement design temperature is 58°C . The minimum pavement design temperature is -34°C .

The reconstruction project involves rubblizing the existing 229 mm of continuous reinforced concrete pavement (CRCP) and overlaying with three different asphalt concrete mixes and thicknesses. There are no other specific pavement studies (SPS) or supplemental sections associated with this site. The nearest General Pavement Studies (GPS) site is 261013 located on US-131 about 80.5 km north of this site.

1.2 Project Location

The Michigan SPS-9A project is located on eastbound Interstate 196 in Ottawa County. This site starts at mile marker 10.55 and ends at mile marker 16.85, just southwest of Grand Rapids. Attachment A is a project location map.

1.3 Project Layout

The Ottawa County SPS-9A site incorporates three SHRP sections. The monitoring sections are 152.4 m long with 304.8 m construction limits. Attachment B contains the test section layout and summarizes the asphalt concrete (AC) thickness and layer descriptions.

1.4 Roadway and Traffic Characteristics

This four-lane divided section of Interstate 196 is located just southwest of Grand Rapids. Table 1 shows traffic data submitted in the nomination form for this site.

Table 1 Traffic data for Michigan SPS-9A

Annual average daily traffic, two way (1994)	32,000 vehicles
% heavy trucks and combinations (of AADT)	11%
1994 est. 18K ESAL rate in study lane (1000 ESAL/yr.)	956 ESAL/yr
Total design 18K ESAL applications in design lane	11,250,300 ESAL
Design Period (years)	20
Legal speed	70 miles per hour

The first two test sections are located on a 1.5 percent upgrade and horizontal tangent (260902 and 260903). The third, 260901, is located on a 0.10 percent downgrade and a superelevation of 0.02 ft/ft on a 00°30'00" curve (arc definition). Section 260901 also has a 381 mm concrete culvert with about 1.2 m of cover. The lanes are 3.7 m wide with an outside shoulder of 2.4 m. All test sections were located in cut sections.

1.5 Limits of Test Sections

Table 2 shows the limits of the test sections at the SPS-9A site. Each test section includes a monitoring section of 152.4 m and 76.2 m at each end of the monitoring section to be used as sampling areas.

Table 2 Limits of Michigan SPS-9A test sections

Test Section #	1000-ft Test Section		500-ft Monitoring Section	
	Beginning Station	End Station	Beginning Section	End Station
260902	1104+50	1114+50	1107+00	1112+00
260901	1125+50	1135+50	1128+00	1133+00
260903	1157+00	1167+00	1159+50	1164+50

1.6 Weather Monitoring

There was no automatic weather station (AWS) unit constructed at this site. The nearest AWS is located at the Michigan SPS-1 site (105 km).

1.7 Traffic Monitoring

A weight-in-motion (WIM) system was installed in the summer of 1996, to classify all individual axles by wheel in all lanes of this section of highway. The WIM equipment used in this project was a DAW-100 unit manufactured by PAT Equipment. Their address is

1665 Orchard Dr
Chambersburg, Pennsylvania 17201
Phone (717) 263-7655

The WIM scale (in each lane) consists of two bending plates mounted in the pavement that cover half of each lane. The bending plates in each lane are staggered with an inductance loop for vehicle classification between bending plates. The WIM device is located in both directions at milepost 65.4 under the 8th Avenue overpass. The first traffic data was collected in October 1996.

1.8 Personnel

North Central Regional Coordination Office

ERES Consultants
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Material Testing

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LTPP Design Review

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David Wilson
Thompson McCully Quarry Inc
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Newport, MI (616) 459-9545

1.9 Known Deviations from Guidelines

Attachment E contains project deviation reports filled out during and after construction

1.10 Summary of Key Construction Equipment

The construction equipment that was used to place the asphalt concrete overlay included the following

- 11-axle loaded flatboy
- Flowboy
- Windrower elevator
- Asphalt paver--Blaw Knox (PF-5510)
- 10 9-ton steel wheel tandem roller
- 12-ton steel wheel tandem roller
- 12-ton pneumatic rubber tired roller (Colwell C530A)
- Static double drum vibrator roller (Colwell C766B)
- Static roller (Colwell C350D)

2 Project Details

Construction for this test section began in late spring 1996 and was completed by early fall of 1996. The Michigan SPS-9A test site consists of three test sections. Attachment B shows the layout of the test sections. This attachment also contains plan figures for each test section.

2.1 Design Features

Table 3 summarizes the layer thickness for each section. Subsurface edge drains were located in all the sections.

Table 3 Summary of material thickness for each section

Test Section Number	AC Thickness (mm) (Surface)	Material and Thickness (mm) (Base 1)	Material and Thickness (mm) (Base 2)
260902	64 mm SUPERPAVE Surface (58-34)	51 mm SUPERPAVE Binder (58-34)	97 mm SUPERPAVE Base (58-34)
260903	61 mm SUPERPAVE Surface (58-22)	43 mm SUPERPAVE Binder (58-22)	97 mm SUPERPAVE Base (58-22)
260901	61 mm 4C Surface (State)	41 mm 3C Binder (State)	81 mm 2C Base (State)

2.2 Material Sampling and Testing

Locations of material sampling and field testing for each layer are given in attachment C. LTPP sampling and field testing procedures have been developed specifically for the SHRP program, and activities were performed in accordance with these guidelines unless noted in attachment E. Samples for laboratory testing were sent to the Michigan Department of Transportation. Samples for long-term storage were obtained from the asphalt concrete based layers.

2.3 Construction Activities

This SPS-9A project involved the reconstruction or rubblizing of the existing 9 in CRCP and overlaying three 304 8-m sections pavement with varying thickness of Superpave material and Michigan DOT specified material, as shown in table 3. No information regarding the rubblizing was submitted by Michigan DOT.

Asphalt Paving

The asphalt concrete plant used was a drum mix from Grand Rapids located a haul distance of 16.1 kilometers from the test site. Paving operations for the base, binder and surface courses were completed the same day they were started in 1996. The base course operations took place in late June and early July, the binder course operations took place on August 5, and the surface course operations took place on September 4. The longitudinal surface joint was located within the lane for the three test sections. Compaction was achieved in three steps: breakdown, intermediate and final. The base, binder, and surface course were paved using a Blaw-Knox PF-5510 with a single pass laydown width ranging between 3.3 and 3.4 m.

Section 260901

The first lift of the Michigan DOT mix base course was broken down by a 12-ton pneumatic-tired roller. The intermediate and final compaction of the first lift was rolled with a 10.9-ton steel-wheel tandem roller. The mean laydown temperature was 144°C with an air temperature of 27°C. The second lift also used the same equipment for compaction, but in a different sequence, 10.9-ton steel-wheel tandem roller for breakdown and compaction and finally a 12-ton pneumatic-tired roller. The air temperature for the second lift was 20°C.

The binder course, 3C Michigan DOT agency mix, had only one lift consisting of breakdown, intermediate and final compaction. The air temperature was 34°C and the mean laydown temperature was 143°C.

The 4C MDOT State Mix was the surface course used for this section. The breakdown and intermediate compaction consisted of two lifts that were compacted by a 12-ton steel-wheel tandem roller. Each lift had three coverages. The final compaction also consisted of two lifts compacted with a 10.9-ton steel-wheel tandem roller. Each lift's compacted thickness was 33 mm and 30.5 mm, respectively. The surface courses mean laydown temperature was 144°C and the air temperature was 26°C.

Section 260902

The base course, SHRP PG58-34, was broken down with a 12-ton pneumatic-tired roller. The intermediate and final compaction of the first lift was rolled with a 10.9-ton steel-wheel tandem roller. The second lift also used the same equipment for compaction, but in a different sequence, 10.9-ton steel-wheel tandem roller for breakdown and intermediate compaction and a 12-ton pneumatic-tired roller for the final compaction. The mean laydown temperature was 152°C and the air temperature was 27°C for the first lift and 20°C for the second lift.

The binder course, SHRP PG58-34, had only one lift consisting of breakdown, intermediate and final compaction on the first lift with a 12-ton steel-wheel tandem and a 10.9-ton steel-wheel tandem roller. The air temperature was 32°C and the mean laydown temperature was 147°C.

The surface course, SHRP PG58-34, had a mean laydown temperature was 154°C and the air temperature was 23°C. The breakdown consisted of two lifts that were compacted by a 12-ton steel-wheel tandem roller. The intermediate compaction was obtained using a 12-ton steel-wheel tandem roller with two coverages on the first lift and four coverages on the second lift. The final compaction was obtained using four coverages with a 10.9-ton steel-wheel tandem roller and two coverages on the second lift with the same equipment. First and second lift compacted thicknesses were 33 mm and 30.5 mm, respectively.

Section 260903

A 10 9-ton steel-wheel tandem roller broke down the first and second lifts of the base course, PG58-22. The intermediate and final compaction for the first and second lifts was obtained using a 10 9-ton steel-wheel tandem roller and a 12 0-ton pneumatic-tired roller, respectively. The mean laydown temperature was 148 °C with an air temperature of 20 °C.

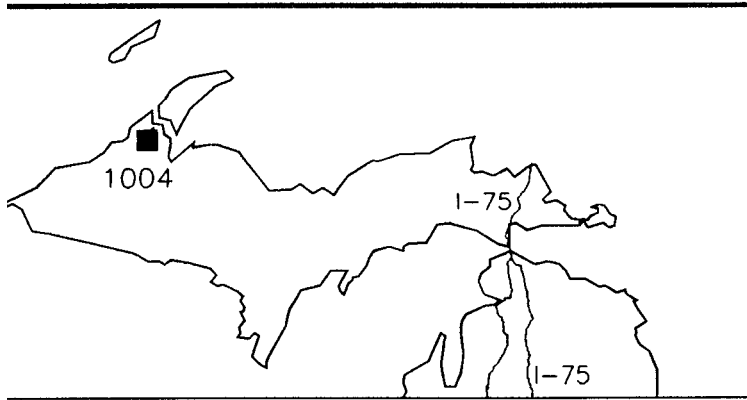
The binder course, SHRP PG58-22, had only one lift consisting of breakdown, intermediate, and final compaction. This compaction was obtained with three coverages with a 12-ton steel-wheel tandem for the breakdown and five coverages for the intermediate. Two coverages with a 10 9-ton steel-wheel tandem roller were necessary for the final compaction. The air temperature was 35 °C and the mean laydown temperature was 143 °C.

The surface course of this section was a SHRP PG58-22. The mean laydown temperature was 146 °C and the air temperature was 29 °C during the first lift and 23 °C during the second lift. The breakdown compaction was accomplished using a 12-ton steel-wheel tandem roller with three coverages on the first lift and two coverages on the second lift. The intermediate compaction was obtained using a 12-ton steel-wheel tandem roller with two coverages on the first lift and four coverages on the second lift. The final compaction was obtained using two coverages with a 10 9-ton steel-wheel tandem roller and four coverages on the second lift with the same equipment. First and second lift compacted thicknesses were 33 mm and 34 mm, respectively.

2.5 Initial Performance

In September 2000, the most recent manual distress survey was performed on all three sections. Low-severity longitudinal cracks totaling 33.5 meters in length were located near the adjacent lane for section 290901. Section 290902 did not have any distress after 4 years of operation. Section 290903 had a total of 42.8 meters of low-severity longitudinal cracking near the adjacent lane and the shoulder edge. No other distresses were noted.

Attachment A
Project Location



Michigan (26)
Eastern Time Zone

Revised 10-26-00

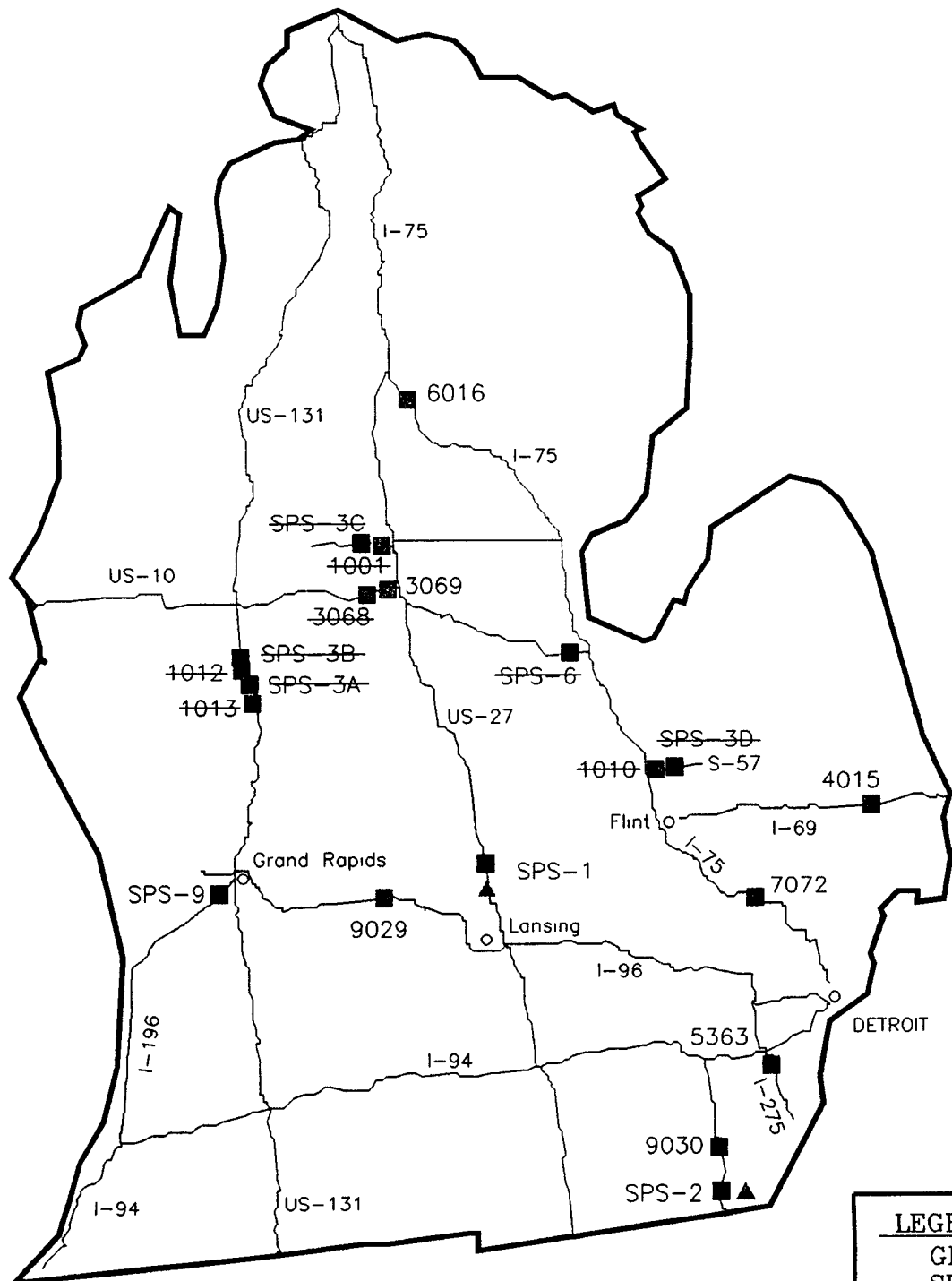
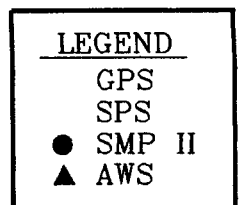


Figure A-1. General Project Location.



Attachment B

Site Layout

MICHIGAN SPS-9

I-196 NB / M.P. 64.6

West of Grand Rapids



"As Built"



260901

61mm 4C Surface (State)/41mm 3C Binder (State)/81mm 2C Base (State)
1158+50



260903

61mm SUPERPAVE Surface (58-22)/43mm SUPERPAVE Binder (58-22)
97mm SUPERPAVE Base (58-22)
1128+00



260902

97mm SUPERPAVE Surface (58-34)/51mm SUPERPAVE Binder (58-34)
64mm SUPERPAVE Base (58-34)
1107+00

• Over 9.5" CRCP (Rubblized)

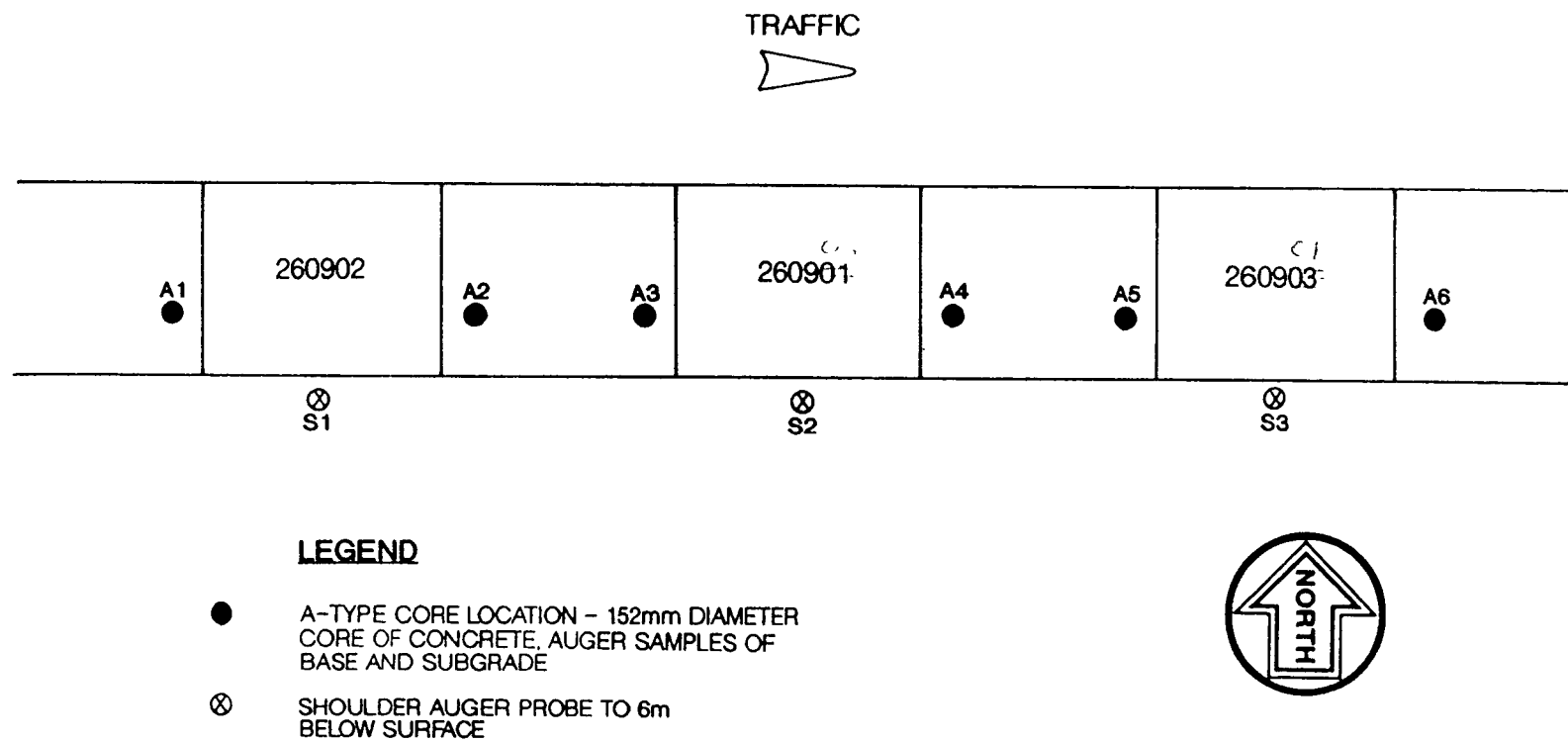
Figure B-1. Michigan 260900 Site Layout

Attachment C
Material Sampling and Testing Plan .

LEGEND

- 150mm DIAMETER CORE AND AUGER LOCATION
- BULK SAMPLE LOCATION (100#)
- △ BULK SAMPLE LOCATION (300#)
- BULK SAMPLE LOCATION (200#)
- ⊗ SHOULDER AUGER PROBE 6m BELOW THE PAVEMENT SURFACE
- 150mm DIAMETER CORE (ASPHALT CONCRETE ONLY)
- ⊕ NUCLEAR DENSITY TEST LOCATION

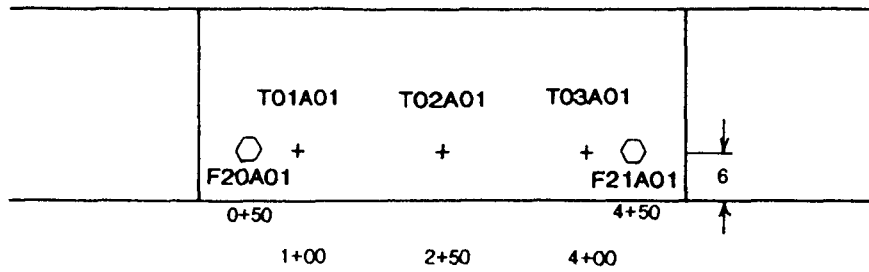
FIGURE 3
LEGEND FOR FIGURES 4 – 7



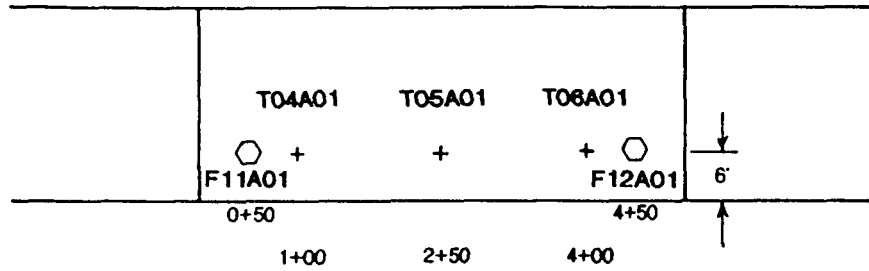
REVISED 7-3-96

FIGURE 4
PRE-CONSTRUCTION SAMPLING

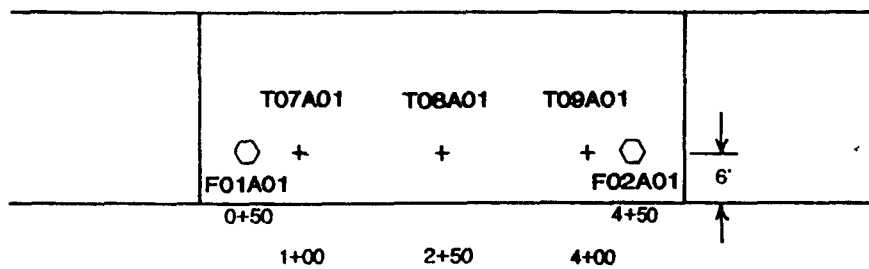
BASE COURSE



BINDER COURSE



SURFACE COURSE



LEGEND

- + DENSITY TEST LOCATION
- BULK SAMPLE LOCATION (100 # EACH)*

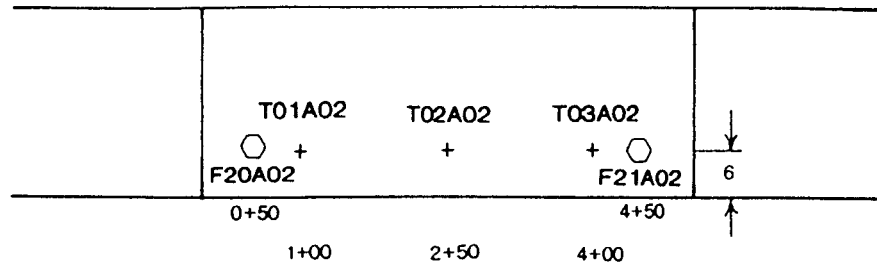
* SAMPLE DESIGNATIONS ARE SHOWN IN SIDE TABLE.

SAMPLE LOCATION	SAMPLE DESIGNATION
F20A01	BT01A01
F21A01	BT02A01
F11A01	BA11A01
F12A01	BA12A01
F01A01	BA01A01
F02A01	BA02A01

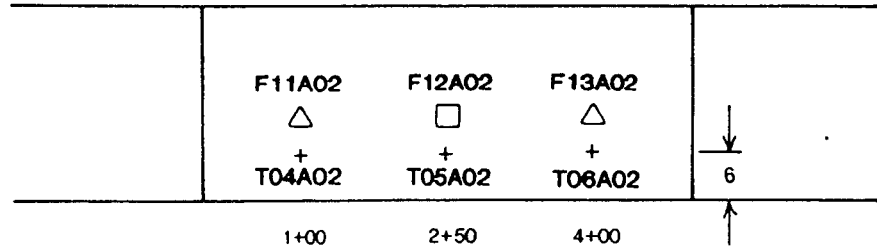
- NOTES:**
- 1) CONDUCT ELEVATION MEASUREMENTS ON RUBBLIZED PCC SURFACE AND THE FINAL LIFT OF EACH COURSE.
 - 2) CONDUCT DENSITY MEASUREMENTS ON FINAL LIFT OF EACH COURSE
 - 3) OBTAIN BULK SAMPLES ON FINAL LIFT OF EACH COURSE AT LOCATION SHOWN WITHIN STUDY LANE OFFSETS SHOWN ARE FOR DENSITY TESTS ONLY

FIGURE 5
CONSTRUCTION SAMPLING AND TESTING
260901

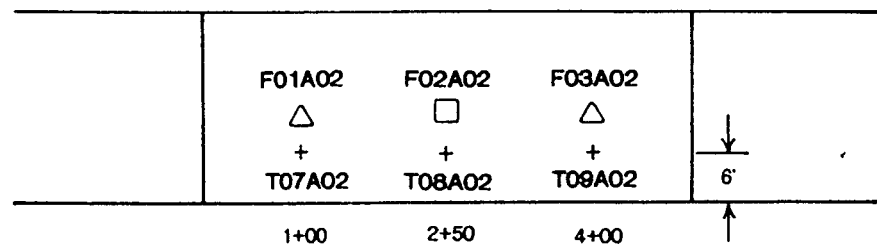
BASE COURSE



BINDER COURSE



SURFACE COURSE



LEGEND

- + DENSITY TEST LOCATION
- BULK SAMPLE LOCATION (100 # EACH)*
- △ BULK SAMPLE LOCATION (300 # EACH)*
- BULK SAMPLE LOCATION (200 # EACH)*

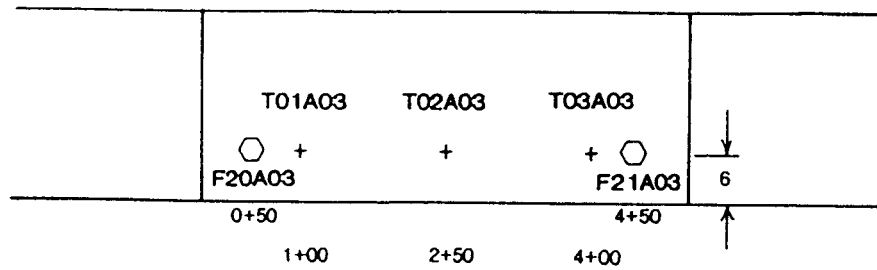
* SAMPLE DESIGNATIONS ARE SHOWN IN SIDE TABLE.

SAMPLE LOCATION	SAMPLE DESIGNATION
F20A02	BT01A02
F21A02	BT02A02
F11A02	BA11A02
F12A02	BA12A02
F13A02	BA13A02
F01A02	BA01A02
F02A02	BA02A02
F03A02	BA03A02

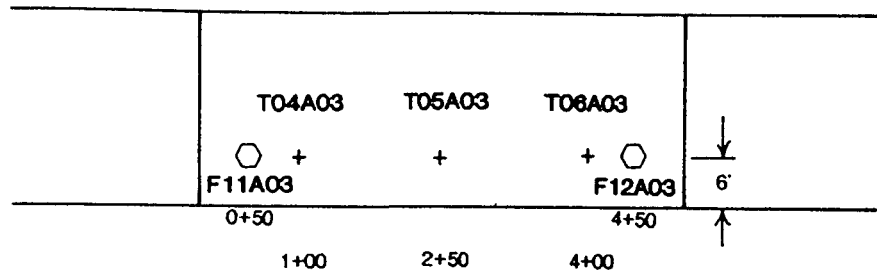
- NOTES:**
- 1) CONDUCT ELEVATION MEASUREMENTS ON RUBBLIZED PCC SURFACE AND THE FINAL LIFT OF EACH COURSE.
 - 2) CONDUCT DENSITY MEASUREMENTS ON FINAL LIFT OF EACH COURSE
 - 3) OBTAIN BULK SAMPLES ON FINAL LIFT OF EACH COURSE AT LOCATION SHOWN WITHIN STUDY LANE. OFFSETS SHOWN ARE FOR DENSITY TESTS ONLY.

FIGURE 6
CONSTRUCTION SAMPLING AND TESTING
260902

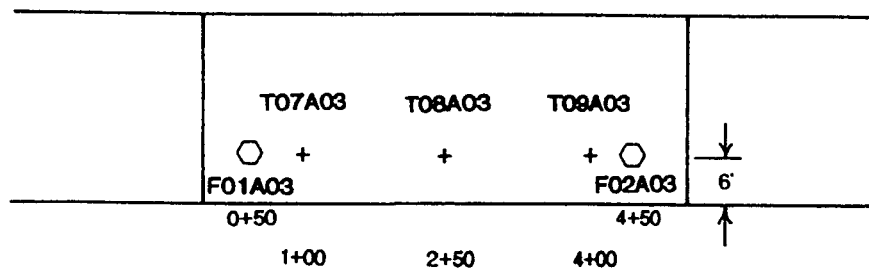
BASE COURSE



BINDER COURSE



SURFACE COURSE



LEGEND

- + DENSITY TEST LOCATION
- BULK SAMPLE LOCATION (100 # EACH)*

* SAMPLE DESIGNATIONS ARE SHOWN IN SIDE TABLE.

SAMPLE LOCATION	SAMPLE DESIGNATION
F20A03	BT01A03
F21A03	BT02A03
F11A03	BA11A03
F12A03	BA12A03
F01A03	BA01A03
F02A03	BA02A03

- NOTES:**
- 1) CONDUCT ELEVATION MEASUREMENTS ON RUBBLIZED PCC SURFACE AND THE FINAL LIFT OF EACH COURSE.
 - 2) CONDUCT DENSITY MEASUREMENTS ON FINAL LIFT OF EACH COURSE.
 - 3) OBTAIN BULK SAMPLES ON FINAL LIFT OF EACH COURSE AT LOCATION SHOWN WITHIN STUDY LANE. OFFSETS SHOWN ARE FOR DENSITY TESTS ONLY

FIGURE 7
CONSTRUCTION SAMPLING AND TESTING
260903

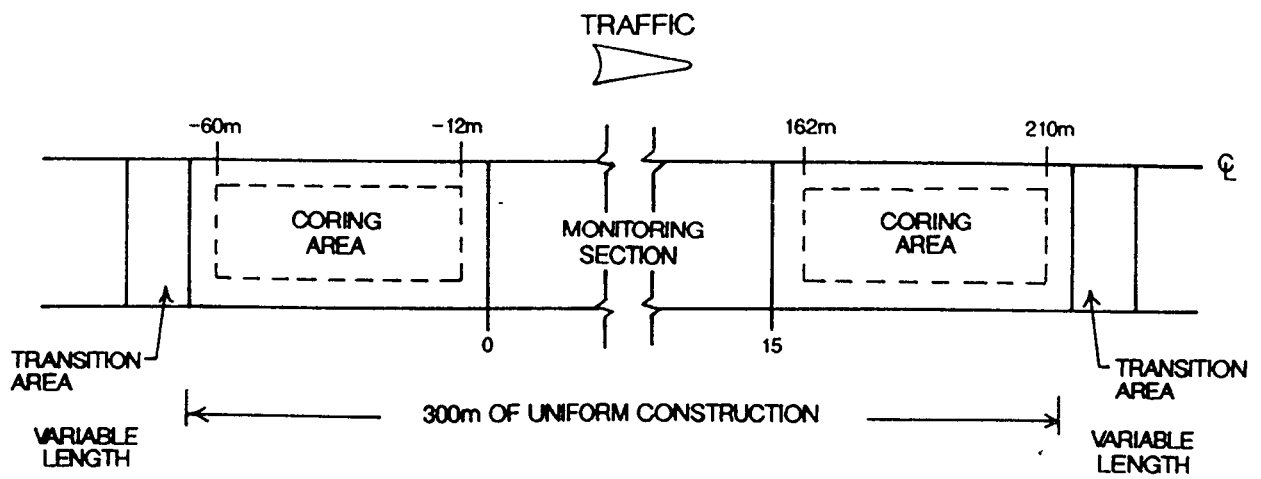


FIGURE 8
CORING AREA FOR SPS-9A TEST SECTIONS

Main Study Test Sections 01, 03

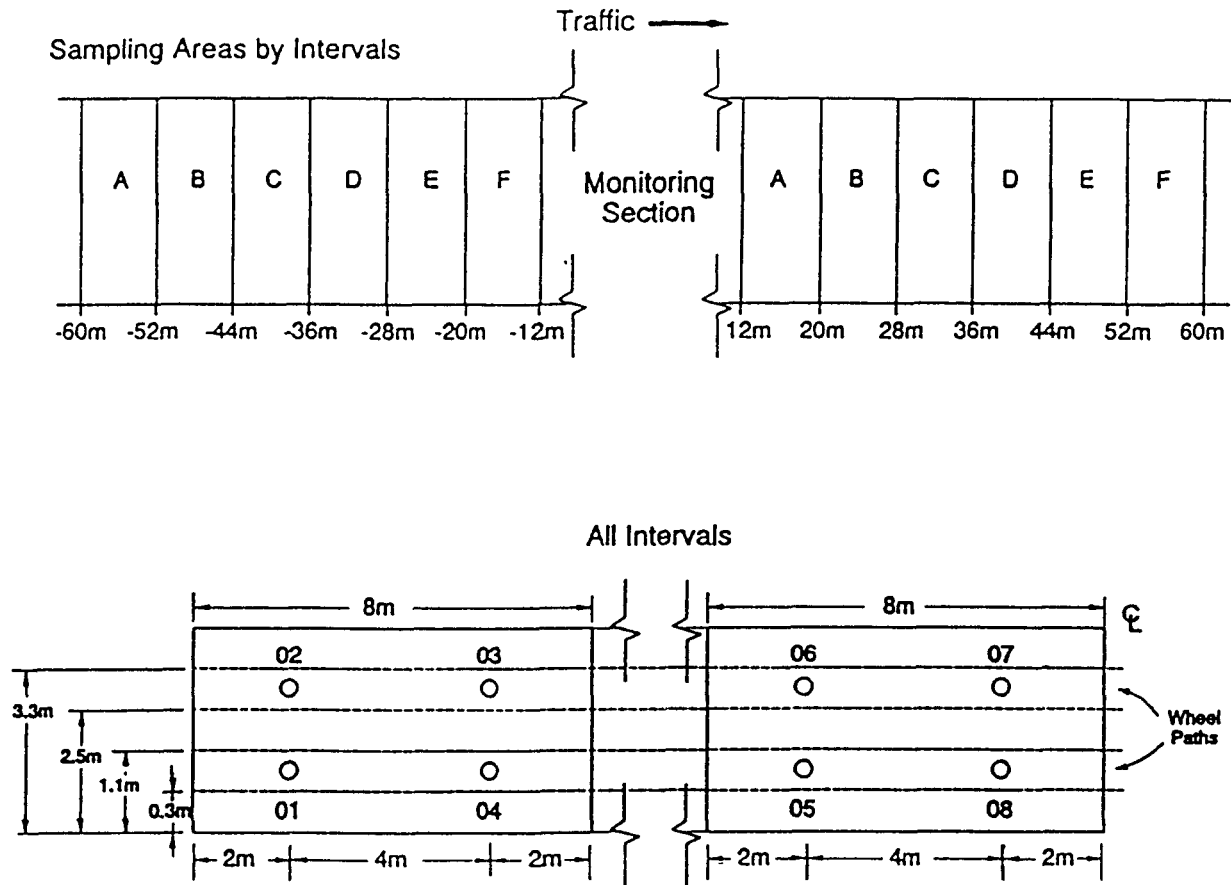


FIGURE 9
CORE LOCATIONS FOR MAIN STUDY
TEST SECTIONS 01 AND 03

Main Study Test Section 02

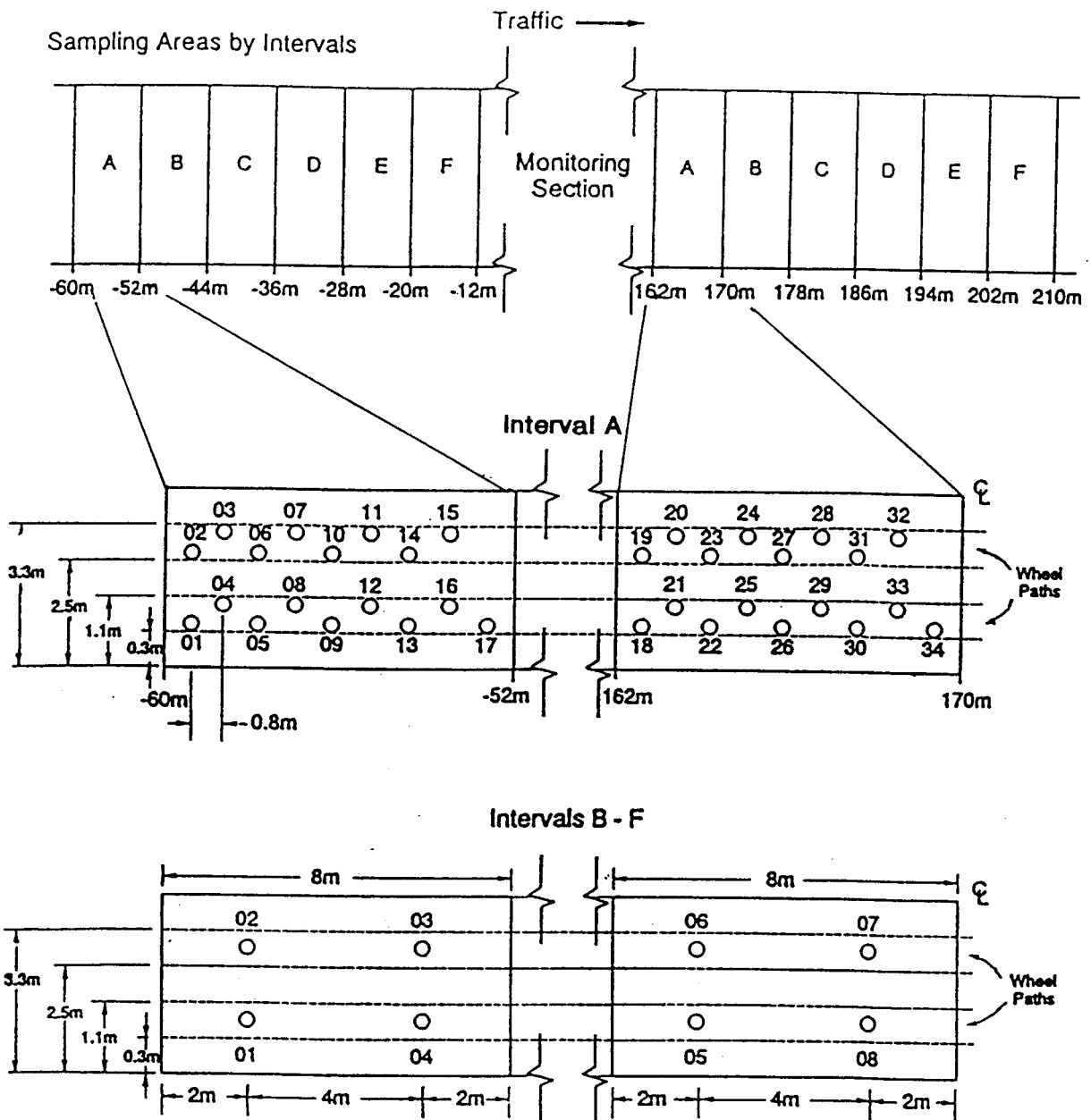


FIGURE 10
CORE LOCATIONS FOR MAIN STUDY TEST SECTION 02,
SUPERPAVE STANDARD DESIGN MIXTURE

Attachment D

Layer Description and Thickness for Each Section

Table D-1 Layer description and thickness for each section

Test Section	Layer Number	Material Code	Description	Average Layer Thickness (mm)
260901 EB	1	131	Subgrade (silty clay)	N/A
	2	202	Subbase (sand)	267
	3	302	Aggregate Base	94
	4	6	Rubblized CRCP	236
	5	321	Dense Graded Asphalt Treated Base (State Mix)	81
	6	1	HMAC binder course (State Mix)	41
	7	1	HMAC Surface course (State Mix)	61
260902 EB	1	131	Subgrade (silty clay)	N/A
	2	202	Subbase (sand)	511
	3	302	Aggregate Base	102
	4	6	Rubblized CRCP	241
	5	321	Dense Graded Asphalt Treated Base (PG 58-34)	97
	6	1	HMAC binder course (PG58-34)	51
	7	1	HMAC Surface course (PG58-34)	64
260903 EB	1	131	Subgrade (silty clay)	N/A
	2	202	Subbase (sand)	279
	3	302	Aggregate Base	107
	4	6	Rubblized CRCP	236
	5	321	Dense Graded Asphalt Treated Base (PG58-22)	97
	6	1	HMAC binder course (PG58-22)	43
	7	1	HMAC Surface course (PG58-22)	61

Attachment E
Project Deviation Reports

LTPP SPS Project Deviation Report Project Summary Sheet		State Code Project Code		<u> 2 </u>	<u> 6 </u>
		<u> 0 </u>	<u> 9 </u>	<u> 0 </u>	<u> 0 </u>
Project Classification Information					
SPS Experiment Number SPS-9		State or Province Michigan			
LTPP Region		<input type="checkbox"/> North Atlantic <input checked="" type="checkbox"/> North Central <input type="checkbox"/> Southern <input type="checkbox"/> Western			
Climate Zone		<input type="checkbox"/> Dry-Freeze <input type="checkbox"/> Dry-No Freeze <input checked="" type="checkbox"/> Wet-Freeze <input type="checkbox"/> Wet-No Freeze			
Subgrade Classification		<input checked="" type="checkbox"/> Fine Grain <input type="checkbox"/> Coarse Grain <input type="checkbox"/> Active (SPS-8 Only)			
Project Experiment Classification Designation (SPS 1, 2, & 8) SPS-9					
Construction Start Date June 1996		Construction End Date September 1996			
FHWA Incentive Funds Provided to Agency for this Project <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					
Deviation Summary					
Site Location Deviations		<input checked="" type="checkbox"/> No Deviations <input type="checkbox"/> Minor Deviations <input type="checkbox"/> Significant Deviations			
Construction Deviations		<input type="checkbox"/> No Deviations <input checked="" type="checkbox"/> Minor Deviations <input type="checkbox"/> Significant Deviations			
Data Collection and Processing Status Summary					
Inventory Data (SPS 5,6,7, & 9)		<input checked="" type="checkbox"/> Complete Submission <input type="checkbox"/> Incomplete <input type="checkbox"/> Data Not Available			
Materials Data		<input type="checkbox"/> All Scheduled Samples Obtained and Tested <input checked="" type="checkbox"/> Incomplete			
Construction Data		<input type="checkbox"/> All Required Data Obtained <input checked="" type="checkbox"/> Incomplete / Missing Data Elements			
Historical Traffic Data		<input checked="" type="checkbox"/> All Required Historical Estimates Submitted (SPS 5, 6, 7, & 9) <input type="checkbox"/> Required Estimates Not Submitted			
Traffic Monitoring Equipment.		<input checked="" type="checkbox"/> WIM Installed On-Site <input type="checkbox"/> AVC Installed On-Site <input type="checkbox"/> ATR Installed On-Site <input type="checkbox"/> No Equipment Installed			
Traffic Monitoring		<input type="checkbox"/> Preferred <input checked="" type="checkbox"/> Continuous <input type="checkbox"/> Minimum <input type="checkbox"/> Below Minimum <input type="checkbox"/> Site Related			
Traffic Monitoring Data		<input checked="" type="checkbox"/> Monitoring Data Submitted <input type="checkbox"/> No Monitoring Data Submitted			
FWD Measurements		<input type="checkbox"/> Pre-construction Tests Performed <input type="checkbox"/> Construction Tests Performed <input checked="" type="checkbox"/> Post-construction Tests Performed			
Profile Measurements		<input type="checkbox"/> Pre-construction Tests Performed <input checked="" type="checkbox"/> Post-construction Tests Performed			
Distress Measurements		<input checked="" type="checkbox"/> Pre-construction Tests Performed <input checked="" type="checkbox"/> Post-construction Tests Performed			
Maintenance and Rehab Data		<input type="checkbox"/> Complete Submission <input checked="" type="checkbox"/> Incomplete <input type="checkbox"/> Data Not Available			
Friction Data		<input type="checkbox"/> Complete Submission <input type="checkbox"/> Incomplete <input checked="" type="checkbox"/> Data Not Available			
Report Status					
Materials Sampling and Test Plan		<input checked="" type="checkbox"/> Document Prepared <input checked="" type="checkbox"/> Final Submitted To FHWA			
Construction Report		<input checked="" type="checkbox"/> Document Prepared <input checked="" type="checkbox"/> Final Submitted To FHWA			
AWS (SPS 1, 2, & 8)		<input type="checkbox"/> AWS Installed <input type="checkbox"/> AWS Installation Report Submitted to FHWA			

LTPP SPS Project Deviation Report Site Location Guidelines Deviations	State Code	<u> 2 </u>	<u> 6 </u>
	Project Code	<u> 0 </u>	<u> 0 </u>

☐

Comments Pertain to All Test Sections on Project

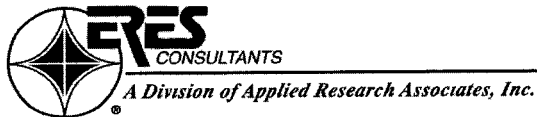
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Comments Pertain Only to Section(s) (Specify) 260901

Site Location Guideline Deviation Comments

There is a 381-mm concrete culvert located within 260901 section This culvert has about 1 2 m of cover

Submitted by



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